REMARKS

The Office Action dated April 21, 2009, has been received and carefully noted. The above amendments and the following remarks are being submitted as a full and complete response thereto.

Claims 13 – 23 are pending in this application. Claims 13 – 19 are rejected. Claims 13, 16, and 19 are amended. Claims 20 – 23 have been withdrawn from further consideration in this application. No claim stands allowed. Support for the amendments may be found in the specification as originally filed, for example, in lines 18 – 20 on page 5, lines 6 – 13 and lines 14 - 18 on page 16. Applicants submit that no new matter is added. Applicants respectfully request reconsideration and withdrawal of the rejections.

Rejection Under 35 U.S.C. §103

Claims 13 – 18 are rejected under 35 U.S.C. §103(a) as being unpatentable over Kajikawa et al. (U.S. Patent No. 4,309,227, hereinafter "Kajikawa") in view of JP 2000-045061 (hereinafter "JP '061"). Applicants respectfully traverse this rejection.

Claim 13 claims a specific nitriding treatment method for performing a nitriding treatment for a workpiece in a heat treatment furnace. The nitriding treatment method comprises a first step of applying a pulse voltage having a predetermined current density at a frequency of not less than 1 kHz between the heat treatment furnace and the workpiece to start heating the workpiece by means of generated glow discharge; and upon a temperature of the workpiece initially arriving above 350° C, a second step of decreasing the current density of the pulse voltage, and then heating the workpiece

up to a desired nitriding treatment temperature by using a heating element arranged around the workpiece, wherein the nitriding treatment is performed by means of nitrogen ion or nitrogen radical generated by the glow discharge (emphasis added).

Kajikawa discloses an improved ion-nitriding process comprising ion-nitriding a workpiece at a high voltage level of glow discharge in a gas atmosphere resulting from the introduction of a gas mixture containing a specific amount of ammonia into a nitriding reactor, and the, further ion-nitriding the same workpiece at a lower voltage level of glow discharge in a gas atmosphere resulting from the introduction of a gas mixture not containing ammonia into the reactor (Abstract).

The specification of Kajikawa referring to the first example shown in Figure 3 states in lines 45 – 59 of column 3:

> "The vacuum reactor 1 is evacuated by the vacuum pump 12, and then charged with hydrogen gas by the gas supplying device 13 to a pressure level of 1-10 Torr. Under such a reducing atmosphere in the reactor 1, the power source is energized to make the element 4 radiate heat, and the power source 7 is also energized so that a DC voltage is applied between the inner insulating pate 5 as anode and the table 14 (the workpiece 8) as cathode to produce a glow discharge. Thus, by the function of the glow discharge and the heat radiated by element 4, the work piece is heated up to a temperature at which the workpiece can be ready to be nitrided, i.e., a temperature in the range of 300° to 570° C, preferably 550° to 560° C."

Further, the specification states from line 67, column 3 to line 15, column 4:

> "After the workpiece is heated up to the desired temperature as stated above, it is ion-initrided by means of a glow discharge in the atmosphere of nitriding gas mixture supplied from the gas supplying device 13. It is noted that the initial stage of the ion-nitriding should be carried out in an atmosphere of a gas mixture containing ammonia in addition to nitrogen and hydrogen, such mixture containing ammonia at least 20% by volume. Such preliminary ion-nitriding is carried out, at a voltage level of the glow discharge higher than that for normal ion-nitriding, for example, at the voltage as high as 560V, and for a short period of time, preferably 15-60 minutes. The rise of the temperature, which would result from the high voltage glow discharge, can be prevented by the temperature controlling device 11 by which the power to be applied to the element 4 is reduced."

Still further, the specification states in lines 19-30 of column 4 referring to the second example shown in Figure 4:

> "As is in the case described with reference to FIG. 3, the reactor 1, evacuated by the pump 12, is charged with hydrogen gas to a pressure level of 1-10 Torr. AC voltage is applied to the element 4 to make is generate heat and further DC voltage is applied to the electrodes by means of the source 7 to produce a glow discharge. Through the glow discharge as well as the heat generated by the element 4, the workpiece is heated up to a minimum temperature at which the workpiece can be nitrided by means of a glow discharge, namely, to 300°- 400°C. "

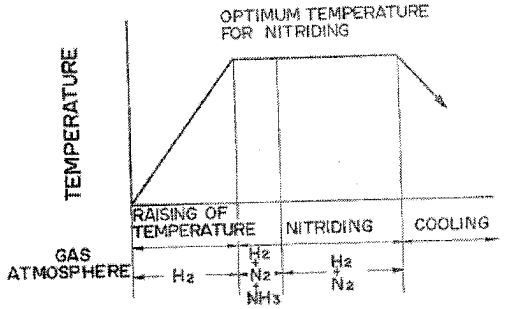
Additionally, in lines 36 – 52 of column 4, the specification states:

> "When the workpiece is thus heated up to the above temperature, the hydrogen gas in the reactor 1 is replaced with a gas mixture of nitrogen, hydrogen and ammonia in which the ammonia is present at least 20% by volume in the gas mixture, and then, the workpiece is further heated up to an optimum temperature for ion-nitriding while the ion-nitriding of the workpiece is carried out at a higher voltage level of glow discharge for example, on the order of 540 V. Even after the workpiece is heated up to the optimum temperature, the glow discharge at the high voltage level is continued at that temperature for a short period of time, preferably for 15 to 60 minutes, where temperature control is accomplished with the temperature controlling device 11 which functions to reduce the output power of the element 4 so that the temperature is kept constant without causing over-heating."

The Office Action characterizes Kajikawa as teaching in materials quoted above a method comprising "a first step of applying a voltage between the furnace and the workpiece to start heating the workpiece by means of generated glow discharge and a second step of decreasing the voltage (i.e., the current density as claimed) after a temperature of the workpiece is in the range of 300 C to 400 C and then heating the workpiece up to a desired nitriding treatment temperature by using a heating element..." (OA, page 3 lines 2 – 6). The Office Action further states that Figures 3 and 4 are only diagrammatic and "do not completely agree with what is described in the specification in terms of heat-radiating element output and glow discharge voltage level at different stages of the nitriding process."

Shown below are Figures 3 and 4 of Kajikawa with annotations t0, t1, t2, and t3 on the time axis.

FIG. 3
(A)



(B)

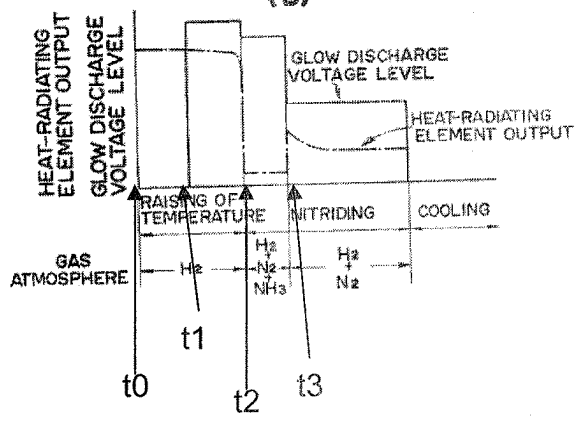
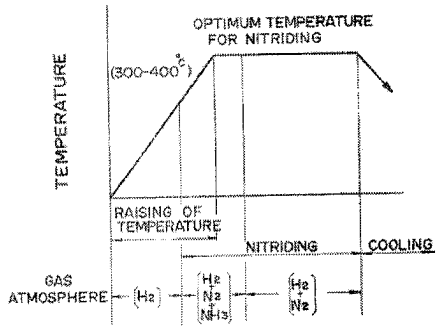


FIG. 4
(A)



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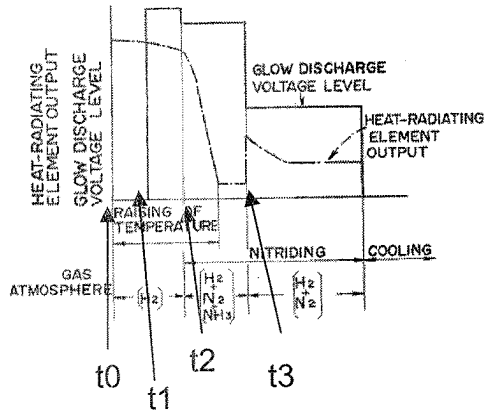


The statements in the Office Action as to the teachings of Kajikawa and as to the lack of agreement between the drawings and the specification are traversed.

First, the Examiner cannot ignore the teachings of the drawings. They must be evaluated for what they reasonably disclose and suggest to one of ordinary skill in the art. *In re Aslanian* 590 F2d. 911, 200 USPQ 500 (CCPA, 1979); MPEP 2125.

Second, the first and third quotes above from the specification of Kajikawa do not specifically set forth the timing of when each heating means begins. In clear contrast, both Figures 3 and 4 do show that at time t0, the heating radiating element output starts

and at time t1, the voltage to produce the glow discharge is applied. While the Examiner is correct that the figures are diagrammatic in that they do not show actual data points with specific units of measure for each of the axes, they certainly show to one of ordinary skill in the art the timing and functional relations of the two different means of heating and the temperature of the workpiece. Kajikawa does not teach first step of applying a voltage between the furnace and the workpiece to start heating the workpiece by means of generated glow discharge as specifically claimed in Claim 13.

Third, the Office Action has clearly mis-characterized Kajikawa as teaching the second step of deceasing the current density after a temperature of the workpiece is in the range of 300° C to 400° C and then heating the workpiece up to a desired nitriding temperature by using a heating element arranged around the workpiece. Simply viewing either of Figures 3(A) and (B) and 4(A) and (B) shows the error of this interpretation. In both sets of Figures and in the description thereof in the Specification, Kajikawa heats the workpiece only by the heating element at the time of start heating from time t0 to time t1. As is evident in Figures 3(B) and 4(B), the glow discharge voltage level is clearly zero (0) for the first one half of the heating curve of Figure 3(B) and one third of the heating curve of Figure 4(A) at t1. Thereafter, from t1 to t2 the heating from the 300° C to 400° C range to the optimum nitriding temperature is taught to be a combination of the glow discharge and the heat radiating element output. The voltage for the glow discharge is not reduce until time t3 after the "preliminary ion-nitriding" is carried out as set forth in the second quote above. It is the output power of the radiating element 4 that is reduced once optimum nitriding temperature is reached as would be evident to any person of skill in the art reading Figures 3(B) and 4(B).

Claim 13 now specifically claims that upon a temperature of the workpiece initially arriving above 350° C, a second step of decreasing the current density of the pulse voltage, and then heating the workpiece up to a desired nitriding treatment temperature by using a heating element arranged around the workpiece. Figures 3 and 4 of Kajikawa clearly show at time t1 in Figure 3 and time t2 in Figure 4, that the voltage generating the glow discharge is not deceased and that the heating of the workpiece up to the desired nitriding temperature is not done by using a heating element arranged around the workpiece.

Consequently, it is strongly contended that neither step of Claim 13 is taught or suggested in Kajikawa. JP'061 fails to cure these deficiencies.

With respect to Claim 13, the Office Action states on page 4 that Kajikawa does not specify that the heating is effected in the second step such that an amount of heat generated by the heating element is higher than that at any time in the first step as claimed. The Action then contends "that at the beginning of the second step the voltage level of the glow discharge is dropped from 700 V in the first step to 540 V while the workpiece is further heated up to the optimum temperature, indicating it likely that the heat generated by the heating element in the beginning of the second step is higher than that at any time in the first step as claimed." This is a clear mistake of interpretation. As would be readily apparent to one of ordinary skill in the art, the heat radiating element output show in Figures 3 and 4, from time t0 to time t2 far exceeds any other output level of the element during the entire process. The amount of heat generated would be directly shown on the graph. The material in column 4, lines 11 – 15 of Kajikawa clearly states "(t)he rise of the temperature, which would result from the

high voltage glow discharge, can be prevented by the temperature controlling device 11 by which the power to be applied to the element 4 is reduced" (emphasis added). Further, the material in lines 49 – 452 of column 4 states "...temperature control is accomplished with the temperature controlling device 11 which functions to reduce the output power of the element 4 so that the temperature is kept constant withour causing over-heating" (emphasis added). Thus in both examples and in both the drawings and the specification, Kajikawa does not teach or suggest heating is effected in the second step such that an amount of heat generated by the heating element is higher than that at any time in the first step as claimed. JP'061 fails to cure this deficiency.

With respect to Claim 15, the Office Action contends that since Kajikawa does not limit the rate at which the voltage is decreased, it would or could be gradual. This again is a mistaken interpretation and clearly contrary to the teachings of the reference. While the specification is silent as to the rate of decrease, Figures 3 and 4 are plain in that the decrease is a step decrease. If the applicants had intended to teach a gradual decrease, they would have shown the same as curves in the same manner as they showed the decrease in heat-radiating element output on the same graphs. Precipitous step drops are not "gradual" as claimed. The teachings of the reference do not "read" on the gradual decrease as claimed. JP'061 fails to cure this deficiency.

For at least the above reasons, Applicants respectfully request reconsideration and withdrawal of the rejection of Claims 13 – 18 under 35 U.S.C. §103(a) over Kajikawa in view of JP '061.

Claim 19 is rejected under 35 U.S.C. §103(a) as being unpatentable over Kajikawa in view of JP '061 as applied to Claim 13 above, and further in view of JP 09-079912 (hereinafter "JP '912"). Applicants respectfully traverse this rejection.

Claim 19 further claims the nitriding treatment method wherein the temperature of the workpiece is determined by simultaneously detecting a temperature difference between a radiation temperature and a contact temperature of a dummy workpiece arranged in the heat treatment furnace, detecting a radiation temperature of the workpiece, and correcting the radiation temperature of the workpiece with the temperature difference.

Kajikawa teaches having a thermocouple 10 directly present in the reactor measuring the general temperature therein which in turn is used by the temperature controlling device 11 as described above. There is no teaching or suggestion of directly contacting anything in the reactor. There is no teaching or suggestion that there is or would be any difficulty using the general temperature of the space inside the reactor. There is no teaching of record that it would be even desirable to know the surface temperature of the workpiece. The record contains no rational reason for combining JP'912 with Kajikawa.

From the drawings of JP'912, it is readily apparent that there is no dummy workpiece present in a heating furnace where the contact temperature of the dummy workpiece is compared with a radiant temperature of the durnmy workpiece so as to simultaneously provide a correcting temperature difference for the radiant temperature of the actual workpiece. Rather JP'912 teaches performing an experimental determination of the relationship between emissivity under simulated conditions and

actual temperature under that simulation of a stationary sheet simulated to the state of being rolled to provide a later used correction factor to an actual rolling mill situation where the radiation temperature is measured. Even in the experimental determination of JP'912, the actual sheet being simulated is measured both ways. There is no teaching of a dummy workpiece or sheet being measured one way and being compared with a second measurement in another way of a second article in the same simulated environment. There is no teaching of record of the use of a dummy workpiece regardless of whether it is real or simulated. Absent such a teaching, the rejection cannot stand.

Further, the Office Action contends on pages 6 and 7 that it would be obvious to use the method of JP'061 in any application where the contact temperature of the object being measured is difficult to get. There is nothing of record to indicate that getting the temperature of the workpiece in Kajikawa is in any way difficult. The environment of JP'912 is a hot rolling mill where the metal sheets are moving rapidly between massive rollers to be rolled. Contact temperature measurement is out of the question. However, there is no such movement in the apparatus of Kajikawa. There is no teaching or suggestion of record that the simple thermocouple 10 is inadequate. Consequently, no rational reason has been given for the combination of references.

Since there is no teaching or suggestion of using an actual dummy workpiece in the same heating furnace at the same time as the treatment is taking place to provide a real time temperature correction as is claimed in Claim 19, Claim 19 cannot be properly held to be obvious.

Further, JP'912 does not appear to cure any of the above noted deficiencies of Kajikawa and/or JP'061 with respect to any of Claims 13 – 19.

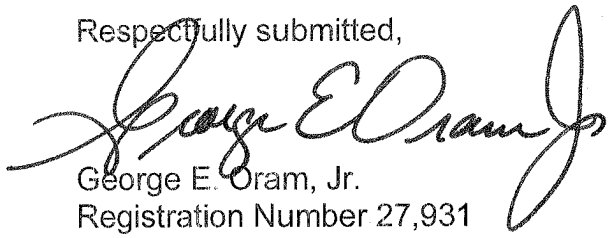
For at least the above reasons, Applicants respectfully request reconsideration and withdrawal of the rejection of Claim 19 under 35 U.S.C. §103(a) over Kajikawa in view of JP '061, and further in view of JP '912.

Conclusion

Applicants respectfully submit that this application is in condition for allowance and such action is earnestly solicited. If the Examiner believes that anything further is desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned representative at the telephone number listed below to schedule a personal or telephone interview to discuss any remaining issues.

In the event that this paper is not being timely filed, the Applicants respectfully petition for an appropriate extension of time. Any fees for such an extension, together with any additional fees that may be due with respect to this paper, may be charged to Counsel's Deposit Account Number 01-2300, referencing Docket Number 025416-00024.

Respectfully submitted,



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